Geothermal Energy Project Brief

Development of an Extended Logging Tool for Geothermal Exploration and Field Development

PURPOSE

Develop an innovative induction (resistivity) borehole logging tool, called "Geo-BILT", for geothermal, oil and gas application that will detect 3D formation structure in the subsurface and delineate near-well fractures.

FUNDING AND OWNERSHIP

Electromagnetic Instruments (EMI) owns the prototype tool. Funding for developing the prototype tool was provided by the California Energy Commission's PIER program in the form of a grant contract. Additional grant funding, from the Commission's Geothermal Resource Development Account, was provided for further demonstration of the tool. Other funding was provided by USDOE and by the developer, EMI.

CEC PIER grant to EMI	$1,380,709
Match funds, DOE	201,526
Match funds, LLNL	725,236
Match funds, EMI	481,195
PIER Project Total	$2,788,666
CEC GRDA grant to EMI	$747, 726
Match funds, EMI	432,542
Match funds, Calpine	316,390
GRDA Project Total	$1,496,658
TOTAL	**$4,285,324**

TOOL DESIGN AND USE

GeoBILT (Geothermal Borehole Induction Logging Tool) was developed to provide a logging tool that can operate at geothermal temperatures, provide three-dimensional single borehole imaging, and map fractures in the subsurface. This is an advance over simple resistivity logging. GeoBilt features a three-component borehole transmitter and a three-component variable offset receiver, allowing it to collect nine-component "vector" data sets, which are needed for delineation of off-axis structure fractures and reservoir inhomogeneities. These features are presently unavailable with any commercial logging system. The instrument also has multicomponent antennas, which will allow for effective logging in highly deviated or horizontal boreholes, which also is not possible with conventional tools.

Various field tests in oil and gas fields and in geothermal fields have been conducted in Texas, California, and Nevada. The development project included design and construction of tool housing, antennas, cooling mechanisms, and electronic components, as well as developing interpretation software (3D modeling codes). The project also included designing a special sling for deploying the 50+ foot long tool down a well. The tool

was designed and manufactured at EMI headquarters in Richmond, California. Lawrence Livermore National Laboratory and Sandia Laboratories contributed to the development of interpretation software.

Additional testing and demonstration will take place at The Geysers, California to further develop the tool and use it to characterize fracture permeability and monitor injection in high-temperature, dry-steam environment and in deviated wells.

BENEFITS

The benefits that a commercially available tool with these capabilities can provide to the geothermal and oil and gas industries are significant. The tool can construct near-well 3D resistivity models and detect permeable horizons and fractures, detect waterflood and injection pathways, and also be used in single-well and cross-well analysis. It provides a significant aid in field characterization for exploration, development and enhancement, with the potential to reduce costs of these activities by 5- 10 per cent.

For more information on this project, contact:

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